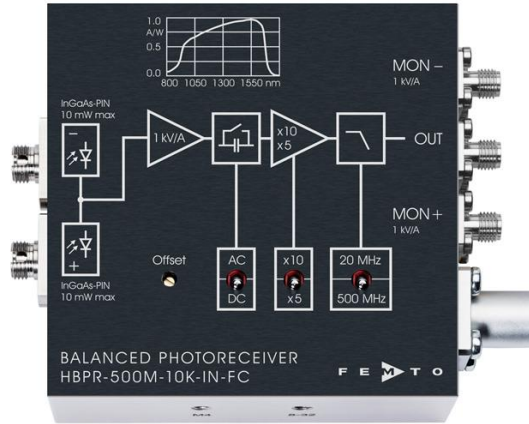


**Datasheet**

**HBPR-500M-10K-IN-FC**

**High-Speed Balanced Photoreceiver**



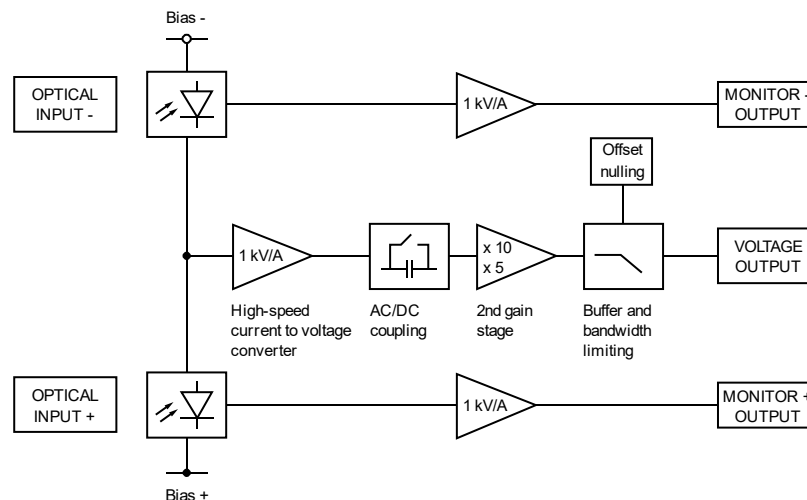
**Features**

- Bandwidth DC to 500 MHz
- Common-Mode Rejection Ratio (CMRR) 45 dB typ.
- InGaAs-PIN photodiodes
- FC fiber optic inputs
- Spectral range 900 - 1700 nm
- Very low NEP, down to 6.7 pW/√Hz
- Transimpedance gain switchable  $5 \times 10^3$  V/A,  $10 \times 10^3$  V/A
- High dynamic input range up to  $2 \times 10$  mW balanced optical power
- Fast monitor outputs with 10 MHz bandwidth and  $1 \times 10^3$  V/A gain
- Switchable low pass filter for minimizing wideband noise
- UNC 8-32 and M4 tapped holes for mounting on standard posts with metric and imperial thread

**Applications**

- Spectroscopy
- Heterodyne detection
- Optical coherence tomography (OCT)
- Optical delay measurement
- Differential optical front-end for oscilloscopes, spectrum analyzers, A/D converters and RF lock-in amplifiers

**Block Diagram**



## High-Speed Balanced Photoreceiver

Available Input Version

HBPR-500M-10K-IN-FC



fix/permanent FC fiber connector for high coupling efficiency, excellent conversion gain accuracy and common mode rejection ratio (CMRR).

Related Models

Various free space or fiber coupled HBPR models, with bandwidth up to 500 MHz, in the spectral range from 320 nm to 1700 nm are available.

Example: FST input



1.035"-40 threaded flange for free space applications, compatible with many optical standard accessories.

See further information and separate datasheets on [www.femto.de](http://www.femto.de)

Available Accessory

PS-15



power supply,  
input: 100 - 240 VAC,  
output:  $\pm 15$  VDC, +400/-250 mA

Specifications

Test conditions

$V_s = \pm 15$  V,  $T_A = 25$  °C, signal output terminated with  $50 \Omega$ , Monitor outputs terminated with  $1 M\Omega$

Gain

Transimpedance gain

$5 \times 10^3$  V/A (2<sup>nd</sup> gain x5),  $10 \times 10^3$  V/A (2<sup>nd</sup> gain x10) switchable (@  $50 \Omega$  load)

Gain accuracy

$\pm 1$  % electrical

Conversion gain

$4.75 \times 10^3$  V/W typ. (@ 2<sup>nd</sup> gain x5, 1550 nm)  
 $9.50 \times 10^3$  V/W typ. (@ 2<sup>nd</sup> gain x10, 1550 nm)

Common mode rejection ratio (CMRR)

55 dB typ. ( $f \leq 100$  MHz)  
45 dB typ. ( $f \leq 500$  MHz)

Frequency Response

Lower cut-off frequency

DC / 10 Hz, switchable

Upper cut-off frequency

500 MHz, switchable to 20 MHz

Time Response

Rise/fall time (10 % - 90 %)

0.78 ns (@ 2<sup>nd</sup> gain x5); 0.9 ns (@ 2<sup>nd</sup> gain x10)  
17.5 ns (low pass filter 20 MHz)

Input

Noise equivalent power (NEP)

minimum  $6.7$  pW/ $\sqrt{\text{Hz}}$  (@ 1550 nm)  
 $6.9$  pW/ $\sqrt{\text{Hz}}$  (@ 1550 nm, 20 MHz)  
 $15.0$  pW/ $\sqrt{\text{Hz}}$  (@ 1550 nm, 200 MHz)  
 $28.0$  pW/ $\sqrt{\text{Hz}}$  (@ 1550 nm, 500 MHz)

Maximum differential CW power for linear amplification

$210 \mu\text{W}$  (@2<sup>nd</sup> gain x5, DC-coupled, 1550 nm)  
 $105 \mu\text{W}$  (@2<sup>nd</sup> gain x10, DC-coupled, 1550 nm)  
 $1.3$  mW (@ AC-coupled, 1550 nm)

Max. optical CW balanced power (common mode power)

10 mW (on each photodiode, @ 1550 nm)

Monitor optical saturation power (limited for linear amplification)

10.5 mW (@ 1550 nm)

## High-Speed Balanced Photoreceiver

Specifications (continued)

Detector	Detector	InGaAs-PIN photodiode FC fiber connector	
	Active area	Ø 80 µm, integrated ball lens suitable for fibers up to 50 µm core diameter	
	Spectral range	900 - 1700 nm	
	Sensitivity	0.95 A/W typ. (@ 1550 nm)	
Signal Output	Output voltage range	±1.0 V (@ 50 Ω load) for linear operation and low harmonic distortion	
	Max. output voltage	±2.0 V (@ 50 Ω load)	
	Offset voltage compensation	±100 mV typ., adjustable by offset potentiometer	
	Output impedance	50 Ω (terminate with 50 Ω load)	
	Slew rate	2800 V/µs	
	Max. output current	70 mA	
	Output return loss S22	-30 dB @ < 100 MHz -20 dB @ < 800 MHz	
	Output noise	2.2 mV <sub>RMS</sub> (15 mV <sub>PP</sub> ) (@ 2 <sup>nd</sup> gain x5) 3.8 mV <sub>RMS</sub> (25 mV <sub>PP</sub> ) (@ 2 <sup>nd</sup> gain x10) 0.25 mV <sub>RMS</sub> (1.7 mV <sub>PP</sub> ) typ. (@ 2 <sup>nd</sup> gain x5, BW: 20 MHz) 0.4 mV <sub>RMS</sub> (2.7 mV <sub>PP</sub> ) typ. (@ 2 <sup>nd</sup> gain x10, BW: 20 MHz) (@ 50 Ω load, no signal on detectors, measurement bandwidth 2 GHz)	
	Monitor Outputs	Monitor output gain	1 x 10 <sup>3</sup> V/A (@ ≥ 100 kΩ load)
		Monitor output voltage range	0 ... +10 V (@ ≥ 100 kΩ load)
Monitor output impedance		50 Ω (terminate with ≥ 100 kΩ load)	
Monitor output max. output current		30 mA typ.	
Monitor output bandwidth		DC ... 10 MHz	
Monitor output noise		0.6 mV <sub>RMS</sub> (4 mV <sub>PP</sub> ) (@ 100 kΩ load, no signal on detectors, measurement bandwidth 200 MHz)	
Power Supply	Supply voltage	±15 V (±14.5 V ... ±16.5 V)	
	Supply current	-90 / +120 mA (depends on operating conditions, recommended power supply capability min. ±200 mA)	
Case	Weight	350 g (0.77 lbs)	
	Material	AlMg3Mn, nickel-plated	
Temperature Range	Storage temperature	-40 ... +85 °C	
	Operating temperature	0 ... +60 °C	

Absolute Maximum Ratings

Max. CW power (averaged)	12 mW (on each photodiode)
Power supply voltage	±20 V

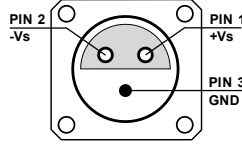
## High-Speed Balanced Photoreceiver

Connectors

Input FC fiber optic connector (FC/PC and FC/APC compatible)

Output SMA jack (female)

Power supply Lemo® series 1S, 3-pin fixed socket  
(mating plug type: FFA.1S.303.CLAC52)



Pin 1: +15 V  
Pin 2: -15 V  
Pin 3: GND

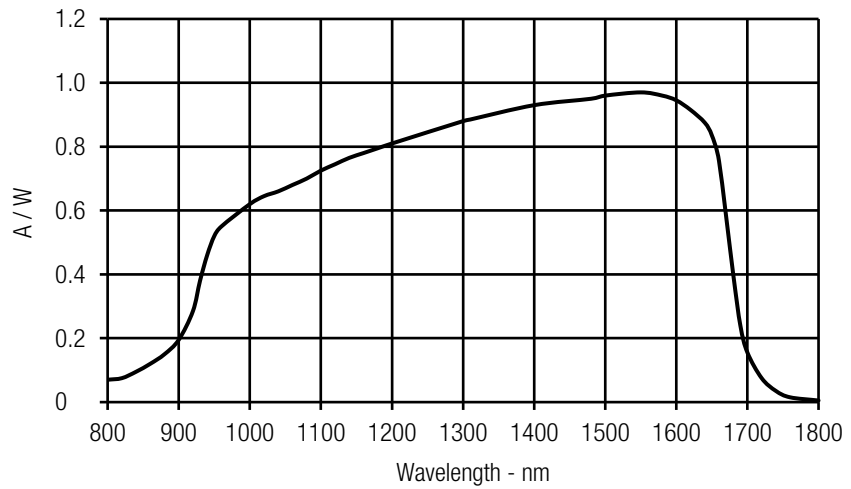
Scope of Delivery

HBPR-500M-10K-IN-FC, Lemo® 3-pin connector, 3 x adapter SMA (male) to BNC (female), datasheet

Ordering Information

HBPR-500M-10K-IN-FC FC fiber optic connector (FC/PC and FC/APC compatible)

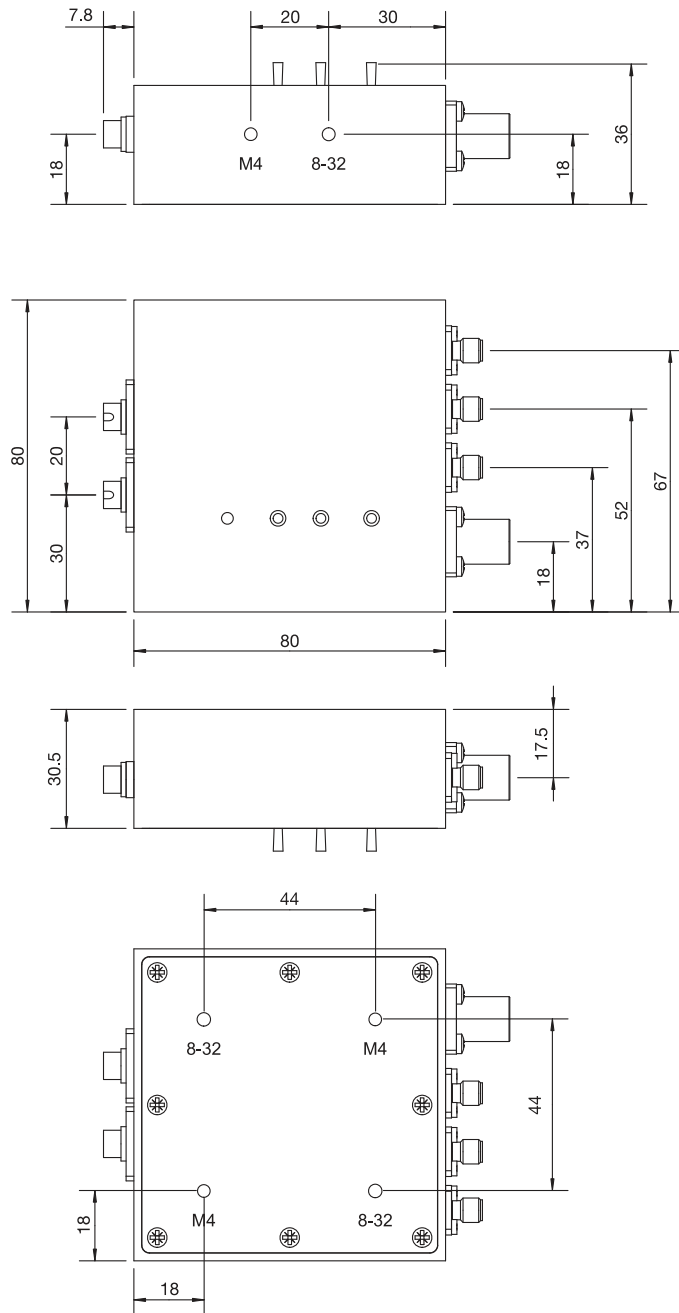
Spectral Responsivity



# High-Speed Balanced Photoreceiver

Dimensions

Case dimensions for HBPR-500M-10K-IN-FC:



All measures in mm unless otherwise noted.

The bottom plate may be rotated to match the appropriate mounting thread to the optical axis by unscrewing the 8 screws.

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